Canaan Valley Institute

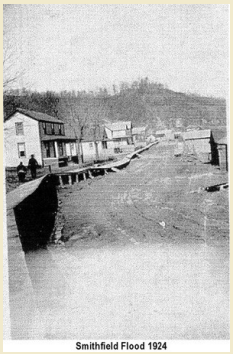
Using the Mike 11 Model To Delineate Flood-Prone Areas in Smithfield, WV

Edward A. Watson
Hydrologist
Canaan Valley Institute
Davis, WV

Smithfield, Wetzel County, West Virginia

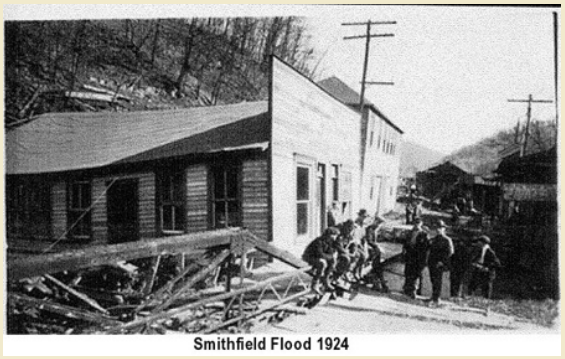
Smithfield circa 1897

Smithfield flood 1924

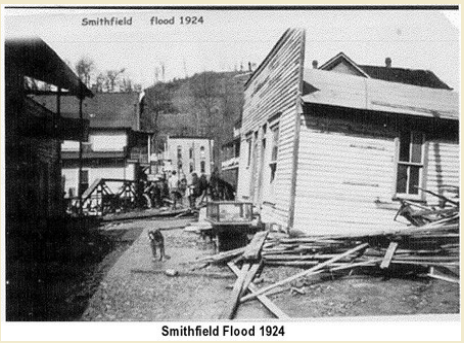


Smithfield flood 1924

Smithfield flood 1924



Smithfield flood 1924

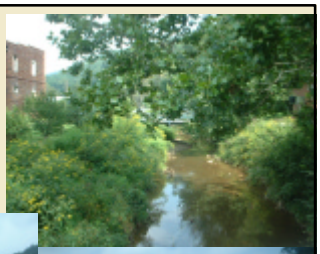


Smithfield Flood 1924

Many more recent floods less well photo-documented:

- 1985
- 1996
- 2000
- Others

Smithfield Present Day



Smithfield Flood Committee's Questions and Concerns

- Why is flooding so frequent and severe?
- Is timber harvest to blame?
- Are culverts, bridges, and the railroad exacerbating the severity and extent of flooding?
- What can be done to minimize effects of flooding locally while not making matters worse down stream?

Bridge designs that neglect sediment routing

Plugged culverts

Extractive industry

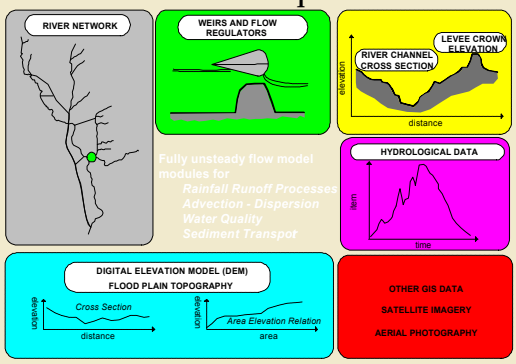
Channelization

The decision was made to conduct a hydrologic analysis of the Upper Fishing Creek Watershed

Mike 11 and Mike 11 GIS

•Mike 11 - A Hydrologic and 1-D Hydrodynamic Model
•Mike 11 GIS - ArcView interface for extracting flood routing information from remotely-sensed data products (e.g LiDAR) and creating flood maps and movies

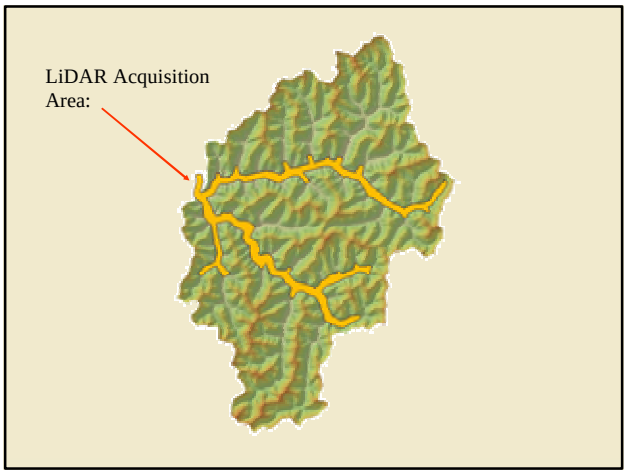
Mike 11 Data Requirements

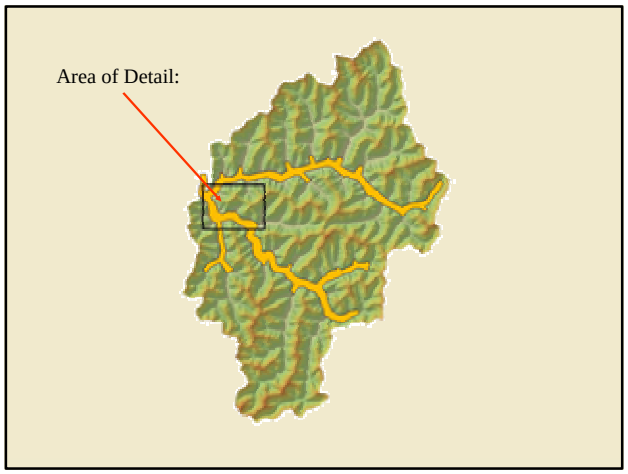


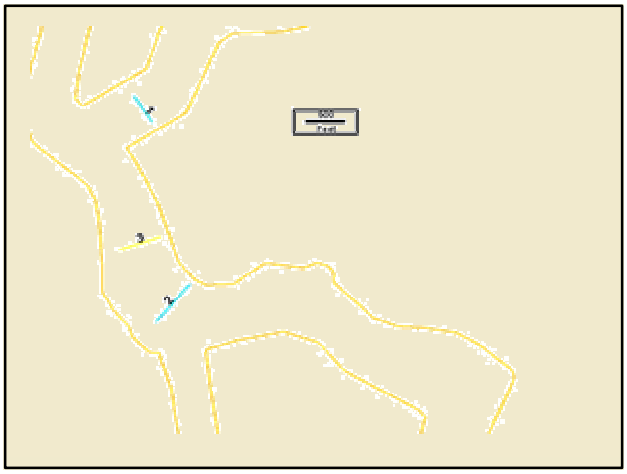
Reliable Data required: 'GARBAGE IN = GARBAGE OUT'

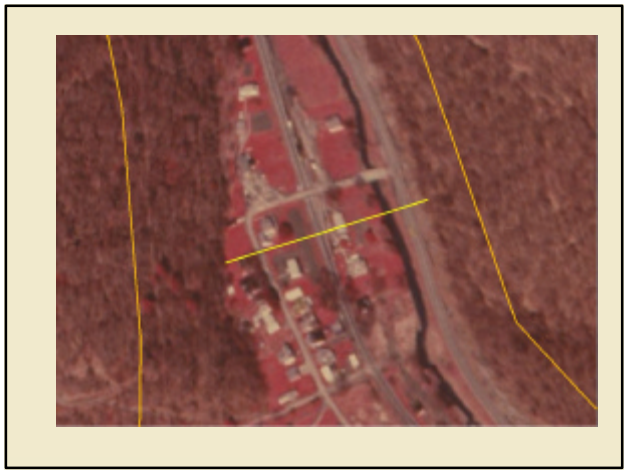
GIS Data Requirements

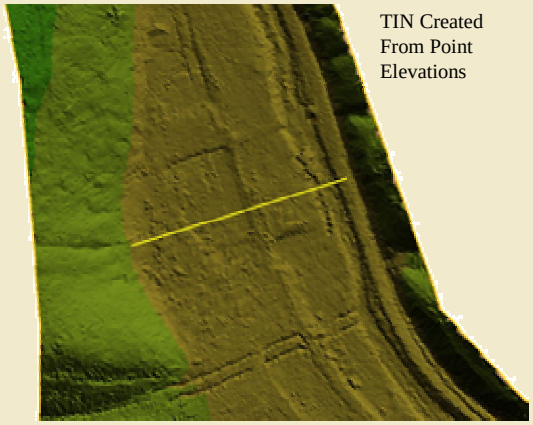
- LiDAR of the Floodplain
- Up-to-date Landuse/Landcover Layer, Classified in-house
- SSURGO Soils Data to determine NAM model parameters


LiDAR Acquisition
Area:

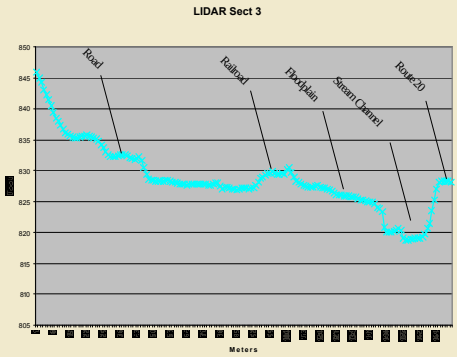

Area of Detail:







TIN Created From Point Elevations

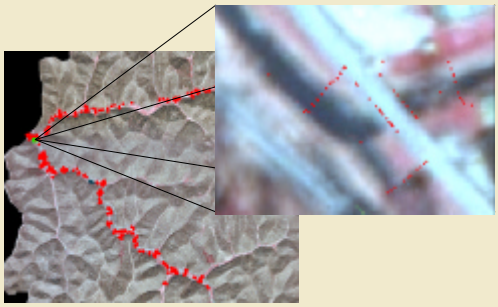


Landcover Classification

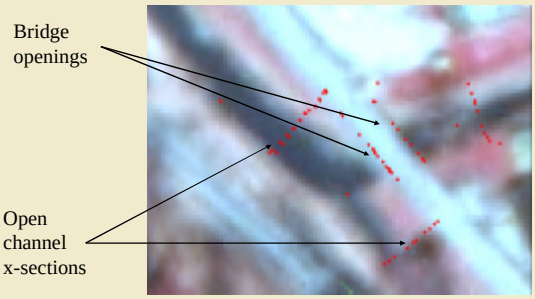
- 9.8.01 Landsat Enhanced Thematic mapper data
- 0.93% impervious
- 6% grass/meadow
- 64% closed-canopy forest
- 29% partial-canopy or disturbed forest

~175 Measured Cross-Sections

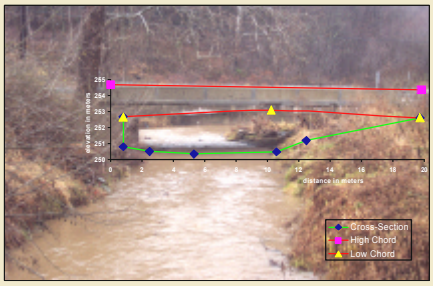
Area of Interest



Close Up

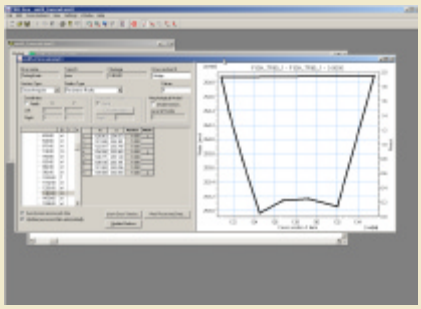


Bridge in X-Section

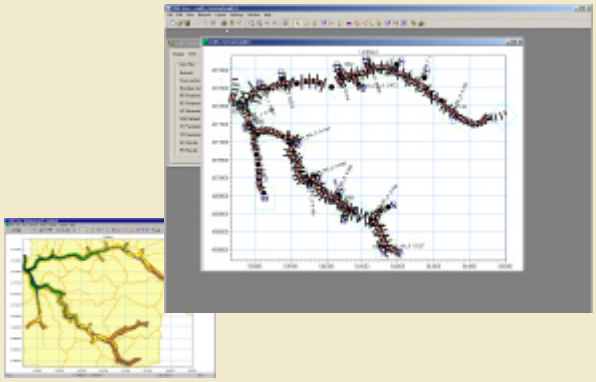


Cross-Section Editor

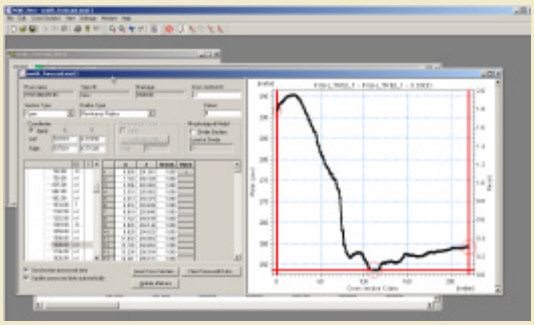
Bridge example



Mike 11 Network View



Mike 11 Cross-Section View

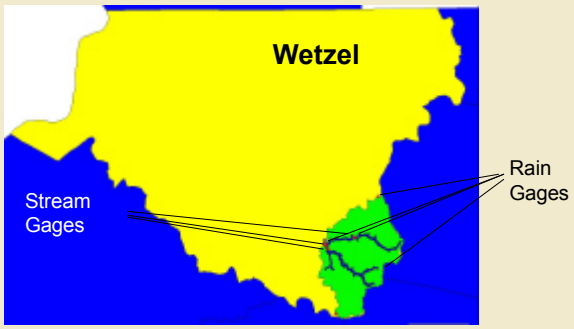


More data requirements

- Streamflow and precipitation data

New Gages were necessary,
as none existed before in
Wetzel County

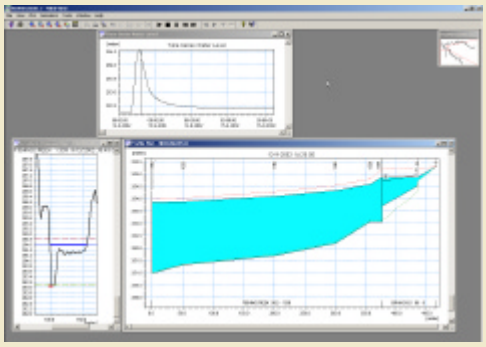
Installed in cooperation with West Virginia Office of Emergency Services



Real-time Rain and Stream data

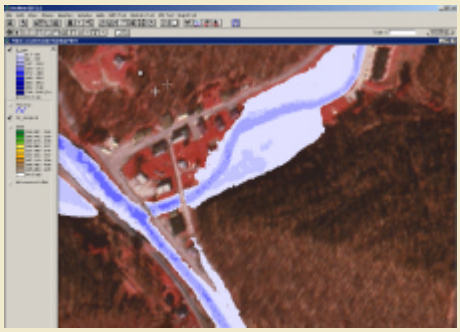
- Facilitated quick calibration of the model
- Permitted the development of a flood prediction model, a module of Mike 11, called “FloodWatch”

Mike 11 Results



Can be converted into Flood Simulation Movies

Flood Simulation Static Images



Scenario Simulations

We have used the modeling process as a framework to examine the factors contributing most to flooding:

Steep slopes (35% mean basin slope)
Narrow, encroached floodplains
Channelization and increased drainage efficiency
Undersized bridges and culverts

We have also simulated the would-be effects of channel enlargement (dredging) and found that nuisance flooding (1-2 year floods) may be contained, but rain events like Southern West Virginia has experienced recently would be uneffected by such measures.

All this is allowing stakeholders to:

- Make informed decisions about where they want to live
- Develop community strategies to mitigate hazards associated with flooding, e.g. evacuation plans and escape routes

Future work may include:

- Modeling hydrologic effects of riparian restoration and reattachment of floodplains with their streams
- Water quality modeling and subsequent remediation

This project was funded by EPA OEI